

one is inspiring, stimulating, the other can scarcely avoid exceeding dullness, and certainly no one ever yet was roused to enthusiasm by a text-book.

The book before us is no worse than most of its kind; indeed, it is a great deal better than many. It is compiled from lectures delivered at the Leland Stanford Junior University, and traces of the originality which must have characterised the lectures of two zoologists of the standing of our authors may be found in the book. Refreshing oases of excerpts from original sources frequently add variety to arid plains of didactic statement, and occasionally one may stumble on a good story; such as that of the frozen fish which, bolted whole by a ravenous dog, later emerged alive and flapping from its prison; or the comment of Yves Delage on Schaffhausen's statement that life must have originated from simple inorganic substances, and taken the form of an uncoloured protococcus which later became *Protococcus viridis*. "If the thing is so simple, why does not the author produce one of these protococci in his laboratory? *On lui ferait grace de la chlorophylle.*"

There is a wealth of process-block illustrations of varying degrees of excellence; some are new, some emerge from the obscurity of scientific journals, and some old friends do duty once again. Frequently there is no reference in the text to the figures, and the intelligent student will ask himself for what purpose they are there. As an example may be taken a very poor figure on p. 306, in the chapter on palæontology; it is entitled "Flying Dragon (Draco)." What is this meant to teach our intelligent student? For all that he may find out from the text it may be a mythical monster, the restoration of some giant fossil form, or the little flying lizard of the Oriental tropics.

The ground covered in this work is immense, as the titles of some of the chapters indicate:—Variation and Mutation, Generation, Sex and Ontogeny, Geographical Distribution, Parasitism and Degeneration, Reflexes, Instinct and Reason. The bearing of palæontology on problems of evolution is discussed in eighteen pages; man's place in nature in seventeen. It is impossible to criticise such pemmican at any length; if it is inaccurate it is worthless; if accurate it is of some value. With few exceptions the accuracy of the authors cannot be called in question; we would, however, protest against the view advanced that, whilst variations in the external organs of ametabolic insects may be due to the influence of environment, the variations of corresponding structures in holometabolic insects are congenital. To use the post-embryonic development of a structure as a criterion whereby to judge the nature of its variation is most unsound, for it is not justified by the results of experiments. So that to state (p. 145), "The variations in the colour pattern of *Diabrotica*, *Hippodamia* and *Vespa* are congenital variations" is, to put it mildly, misleading.

The authors, it is evident, are not supporters of the theory of sexual selection, and all the familiar objections to it are paraded. In this connection it is interesting to read the recently published papers by Mr. Edmund Selous on the courtship of birds; the papers are so admirable that they should be consulted by

everyone interested in the subject, but it is difficult to refrain from quoting the concluding words of the gifted author.

"I would urge that the facts here brought forward by me, in regard to four different species of birds, are, both singly and cumulatively, strongly in support of Darwin's second great hypothesis of sexual selection, and I believe that, as denial from the chair is replaced or supplemented by evidence from the field, the views of that great naturalist and reasoner will be triumphantly and often most strikingly vindicated."

The insects shown in Fig. 251 are not Membracidae or leaf-hoppers of the order Hemiptera, but Acridiidae or grasshoppers of the order Orthoptera. Schaudinn is misspelt Schaudin, and Chillingham Chellenham; there are also one or two obvious misprints. The names of some of the animals quoted are strangely unfamiliar. One might ask the nature of a piddock, a cusk, a silverside, a killifish if the Latin equivalents were not also given, and once again we have occasion to bless the name of Linnæus.

R. S.

#### STUDIES IN EDUCATION.

*The Practice of Instruction.* Edited by Prof. J. W. Adamson. Pp. xxi+512. (London: The National Society's Depository, n.d.) Price 4s. 6d. net.

IT has been a favourite plan with English publishers to issue a text-book on teaching made up of separate essays on the teaching of various subjects, with an introduction on general principles of education written by the editor. Mr. P. A. Barnett's "Teaching and Organisation" was the first in the field, and now Prof. Adamson has prepared a similar volume for the National Society.

We confess that we somewhat distrust this method of putting a book together. It is difficult to secure cohesion; some of the essays are pretty certain to disappoint the editor, and such a book can very seldom be adopted for regular use by a body of students. In the volume before us one-third is contributed by the editor, and he provides a really able introduction to the psychology of the schoolroom; there are omissions which betray the author's lack of sympathy with the more practical needs of the young, but within the prescribed limits Prof. Adamson is helpful and clear, and a section devoted to experiments in curriculum and method shows that he is both alive to what is being done at home and abroad, and that he is in sympathy with cautious educational reform.

The rest, two-thirds of the volume, is distributed among ten writers, and some of the essays are of most excellent quality; but Principal Headlam on religious instruction, and Miss Howard on history, are weak performances. Dr. Herbertson's essay on geography contains the views with which, the Geographical Association has made us familiar, but it is very evident that much of the work which he prescribes for children has never been taught by himself, and an air of unreality pervades his proposals. In these three sections we feel sure that the editor would have done better to have worked up

the exposition himself, for his introduction shows that he has a good acquaintance both with the capacities of children and with the way in which these studies may be utilised to serve the ends of mental development. Neither Miss Howard nor Dr. Herbertson seem to have got much beyond the primitive idea that children possess empty knowledge boxes into which geographical and historical information can be shot at will.

The other sections are on a higher level. Mr. Baker's account of mathematics is quite good, and will be helpful to teachers in any type of school; but his treatment suffers from compression, for it is impossible to cover in the space allotted the whole field of study from the infant stage to the commencement of trigonometry. Natural science fares well in the hands of Dr. Percy Nunn and Miss von Wyss, and any teacher of science, especially in secondary schools or technical institutions, will profit from studying with care their exposition of method. In their selection of sciences for the "intermediate" and "final" stages we are inclined to think the writers take too narrow a view; botany, chemistry, and physics have their place, but many would prefer, especially in view of the increasing claims of hygiene, to see more recognition given to physiology in the year or two preceding the scholar's departure from school. Languages have been placed in the hands of Dr. Rouse (aided by his colleague, Mr. W. H. S. Jones) for Latin and Greek, and Mr. Mansfield Poole for French and German. Both belong to the ranks of avowed "reformers." Many schoolmasters will rub their eyes with blank amazement on reading the specimen lessons in Greek dialogue as conducted in the Perse Grammar School, but Dr. Rouse's system is merely the application of the same general principles which Mr. Poole expounds for a modern language.

On closing the book one is encouraged to recognise the progress that English teachers are making in the serious study of professional work. Ten years have elapsed since Mr. Barnett edited the pioneer volume of this description, and the comparison is favourable to the craftsman schoolmaster of the present day.

#### MAINTENANCE OF ROADS.

*Road-making and Maintenance. A Practical Treatise for Engineers, Surveyors, and Others.* By Thomas Aitken. Second edition. Pp. xviii+527; illustrated. (London: Charles Griffin and Co., Ltd.) Price 21s. net.

THE first edition of this book was published in 1901, and the fact that a second edition of a technical book of this character should be called for within so short a period testifies to its value, and also to the greater attention that has been given to the maintenance of roads within the last few years.

After the advent of railways, and the abolition of turnpikes, road-making became a very neglected science; the advent of bicycles and the inconvenience felt by a very large section of the public caused pressure to be brought on highway authorities, and a gradual improvement set in. The subsequent intro-

duction of motor-cars brought road maintenance very much to the front, and, taken generally, the main roads of this country are now kept in very fair condition. This, however, has involved a very large expenditure. It was stated at a recent discussion on motor vehicles at the Institution of Civil Engineers by the surveyor of the county of Middlesex that the cost of main roads in his county had increased from 49,000*l.* in 1889 to 90,391*l.* in 1905. In the two years 1904-6 improvements on the roads had amounted to 86,536*l.* The cost of the main roads of England and Wales has increased from 2,120,332*l.* in 1901 to 2,478,481*l.* in 1905.

The book now under notice has been revised and brought up to date, and much new matter has been added. The question of damage done to the roads by motor-cars, and the nuisance arising from dust caused by the speed at which these vehicles are driven, has been fully treated in a new chapter. A description of the various remedies that have been tried for dealing with the dust problem is given. The conclusion at which the author has arrived is that no real solution for dealing with this nuisance has yet been found, but he has no doubt that the system of "tar macadam" or "building up the road stone coating with a matrix of tar, chips and dust as a binding medium is the best possible method of solving the dust problem in a satisfactory and permanent manner."

The advantages of tar macadam are increased durability over ordinary macadam, imperviousness to moisture, capability of being kept clean, and the surface is not liable to be disintegrated by frost. Owing to its greater durability and to the fact that the surface of the road can be renewed by a thin coating of fine tar macadam, from time to time, without disturbing the subsurface or foundations, the cost over a series of years, when everything is taken into consideration, is not more than that of a steam-rolled ordinary macadam road. The author of this book, however, expresses the opinion that its first cost prohibits its adoption on an extensive scale on rural main roads.

The book is divided into eighteen chapters, dealing in an exhaustive and practical manner with the following subjects:—Historical sketch of road-making; resistance to traction on roads; laying out new roads and the improvement of those already made; retaining walls, culverts, bridges, &c.; materials used for repairs; quarrying road stone; breaking and haulage; rolling and scarifying; prevention of dust; footways; wood pavement; asphalt; brick pavement; tar macadam; testing the surface of roads and use of the viagraph; subways.

#### OUR BOOK SHELF.

*A History of Chemistry.* By Hugo Bauer. Translated by R. V. Stanford. Pp. vii+232. (London: Edward Arnold, 1907.) Price 3s. 6d. net.

THE philosophy of chemistry can only be properly studied by the historical method. Present-day chemical philosophy, like present-day religion, is a product of evolution, and to understand it thoroughly it is necessary to be able to trace the successive stages